

LEPROSY

HYGIENE & DISEASES

OF

WARM CLIMATES.

EDITED BY

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ILLUSTRATED WITH ENGRAVINGS AND FULL-PAGE PLATES.

EDINBURGH AND LONDON:
YOUNG J. PENTLAND.

1893.

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CHAPTER XI.

LEPROSY.

BY C. N. MACNAMARA, F.R.C.S.

History.—The history of leprosy is confused in consequence of what we now recognise as distinct and separate diseases having been described under the term leprosy. For instance, leucoderma and elephantiasis have both been included under the heading of leprosy; the Bible mentions a person as “a leper as white as snow,” in other words, he suffered from leucoderma. Again, P. Ægineta observes: “If cancer, which is, as it were, an elephantiasis in a particular part, is ranked among the incurable diseases by Hippocrates himself, how much more is elephantiasis incurable, which is, as it were, a cancer of the whole body? Wherefore, those who are already overpowered by the disease must be abandoned; but when the affection commences so as that none of the extremities have fallen off, or the surface of the body become ulcerated, nor the hard swellings appeared, and the face merely looks foul, but not altogether unseemly, we must attempt a cure.” The disease here referred to as elephantiasis was evidently a form of leprosy. Isidorus, of Saville, tells us that they called it elephantiasis because it was a mighty disease; sometimes leontium or morbus leoninus, from the supposed resemblance of the eyebrows to those of a lion. Dr. Adams, in his commentary on these observations of Ægineta and Isidorus, remarks that the Greek translators of the Arabian physician Avicenna rendered the Arabic word *juzum* or *judam* by *lepra*; but unfortunately they called quite a different affection “elephantia,” from its resemblance to the leg of an elephant; and the Greeks, who had been accustomed to designate leprosy as elephantiasis, came to mix up elephantiasis with leprosy. To make matters worse, of late years *lepra*, a form of skin disease classed by Willan under the order of *Squamæ*, has also been described as leprosy.

Out of all this confusion of terms, pathology has at last led us to recognise the fact that leprosy is the effect of a micro-organism,

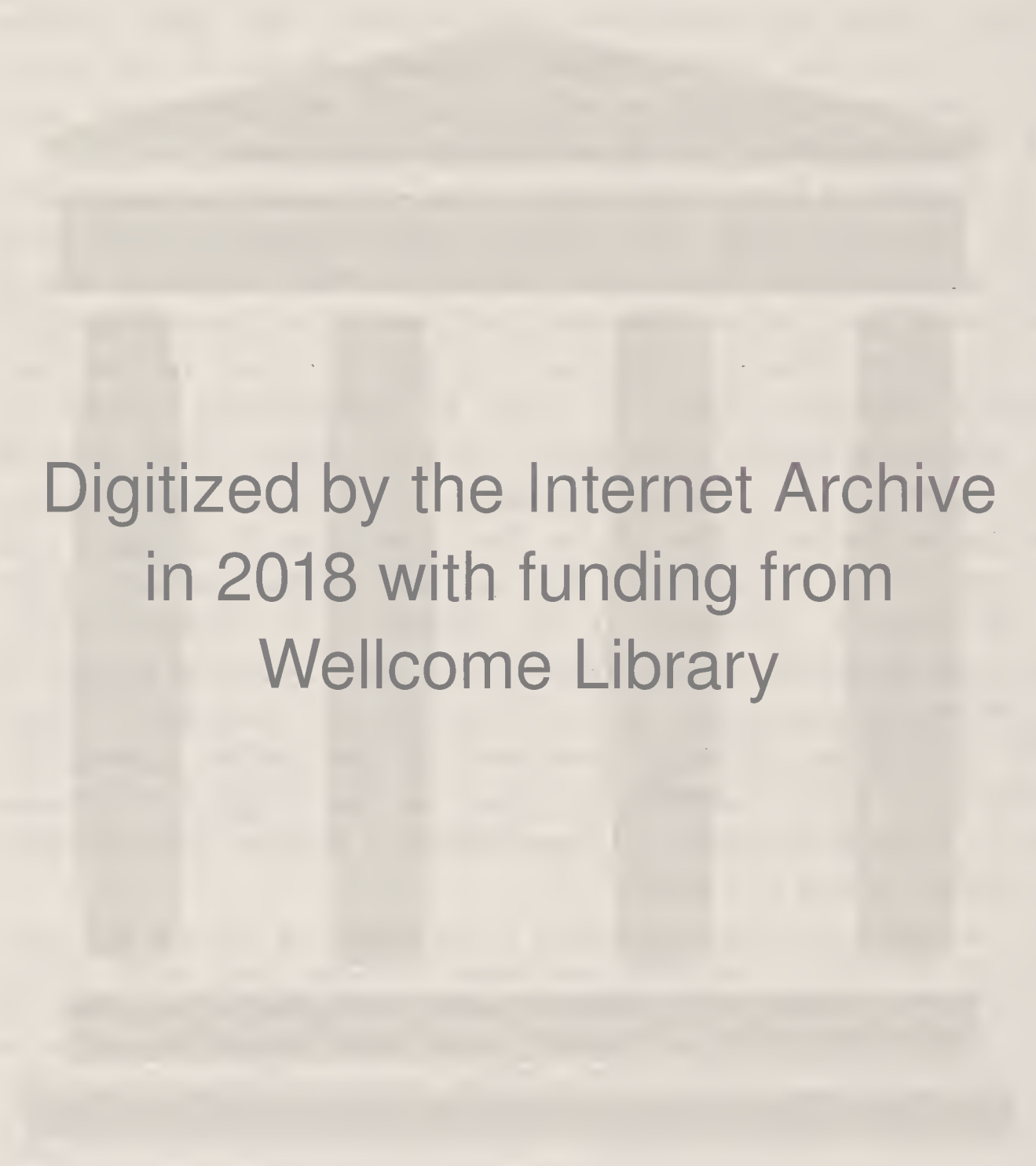
which, if it becomes located in the skin causes tubercular leprosy; but if its action is confined to the nerves, it produces "nerve leprosy"; frequently these two forms of disease exist in the same individual, in which case the person is said to suffer from "mixed leprosy."

Leprosy must have existed in Egypt from the time of Moses. Manetho, writing 260 B.C., states that a vast number of Jews suffered from this disease, and were in consequence expelled from Egypt. In India, Susruta, 400 B.C., describes leprosy as being common among the inhabitants of Hindostan; the early Chinese authors also refer to the disease. Leprosy, though of rare occurrence, was known in Italy as early as A.D. 53, and before that time had been described by Greek and Arabian physicians.

In England a leper or lazaret-house was established at Canterbury in the year A.D. 1096. The disease would appear to have made rapid strides both in this country and in the West of Europe during the time of the various Crusades; and some of our best authorities are of opinion that the evidence is strongly in favour of the idea, that the Crusaders had much to do in disseminating the disease throughout the regions from which they came, and to which many of them returned after visiting Palestine. It is certain that between the time of the foundation of the first leper-house in England and the year 1472, no less than 112 similar institutions were built in this country. Michaud, in his *History of the Crusades*, states "that the historians we have followed are silent as to the ravages of leprosy among the nations of the West; but the testament of Louis VIII. (1226), an historical monument of the period, attests the existence of 2000 hospitals for lepers in the kingdom of France alone." The total number of leper-houses in Europe was estimated by Matthew Paris at 19,000.

Sir J. Simpson observes, according to the record of Edward III., that king sent, in 1346, "a commandment under his Great Seal to the Mayor and Sheriffs of London, willing them to make proclamation in every ward of the city and suburbs, that all leprous persons within the said city and suburbs should avoid within fifteen days, and that no man suffer any such leprous person to abide within his house, upon pain to forfeit his said house, and to incur the king's further displeasure. And that they should cause the said lepers to be removed into some outplaces of the fields, from the haunt and company of all sound people."

The leper was not looked upon in the eye of the law alone as defunct, for the Church also took the same view and performed the solemn ceremonials of the burial of the dead over him on the day on which he was separated from his fellow-creatures and consigned to a lazaret-house. He was from that moment regarded as a man dead amongst the living, and legally buried, though still breathing and alive. The ritual of the French Church retained till a late period the various forms and ceremonies to which the leper was subjected on the day of his living funeral.



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A priest, robed with surplice and stole, went with the cross to the house of the doomed leper. The minister of the Church began the necessary ceremonies by exhorting him to suffer, with a patient and penitent spirit, the incurable plague with which God had stricken him. He then sprinkled the unfortunate leper with holy water, and afterwards conducted him to the church, the usual burial verses being sung during their march thither. In the church the ordinary habiliments of the leper were removed; he was clothed in a funeral pall; and while placed before the altar between two trestles, the *Libera* was sung, and the mass for the dead celebrated over him. After this service he was again sprinkled with holy water, and led from the church to the house or hospital destined for his future abode. A pair of clappers, a barrel, a stick, cowl, and dress, etc. etc., were given to him. Before leaving the leper, the priest solemnly interdicted him from appearing in public without his leper's garb; from entering inns, churches, mills, and bakehouses; from touching children or giving them aught he had touched; from washing his hands, or anything pertaining to him, in the common fountains and streams; from touching in the markets the goods he wished to buy with anything except his stick; from eating or drinking with any others than lepers; and he especially forbade him from walking in narrow paths, or from answering those who spoke to him in the roads and streets unless in a whisper, that they might not be annoyed with a pestilent breath, and with the infectious odour which exhaled from his body; and last of all, before taking his departure and leaving the leper for ever to the seclusion of the lazaret-house, the official of the Church terminated the ceremony of his separation from his living fellow-creatures, by throwing upon the body of the poor outcast a shovelful of earth, in imitation of the closure of the grave.

From the year 1420, and even before that date, there had been a decided diminution in the number of lepers in England. A Commission appointed in the reign of Edward IV. (1470) to inquire into the matter, reported that there were very few lepers left in any of the lazaret-houses. The disease continued to linger on in the Shetland Islands¹ until the end of last century, but practically it had disappeared from England before Henry VIII. came to the throne. In Italy, in like manner, leprosy had almost ceased to exist by the year 1510, and somewhat later in France. In the sixteenth century the disease had become so rare in Denmark that the leper-houses were abolished; but it continued to prevail in Sweden until the end of the eighteenth century. Whilst the disease was thus dying out of Europe, lepers everywhere being treated by isolation in the manner above described, it has continued, and still prevails, over the greater part of Asia, where no such system of isolation has ever been enforced.

Dr. G. Thin, in his work on leprosy, published in 1891, p. 42, observes that "it is clearly established that leprosy was introduced into Italy about the time of Christ, and that from Italy it spread

¹ Dr. Edmonston met with a case of leprosy in Shetland in 1809, and Dr. Broadbent exhibited to the Medico-Chirurgical Society of Edinburgh, on the 6th June 1855, a case in a young man from the Hebrides.—EDITOR.

(following the Roman armies and main routes) into countries in Northern and Western Europe. Within a few centuries of its first spreading into these countries, it had multiplied to such an extent as to have inspired the whole of Christendom with horror and fear. The disgust and terror which it evoked, roused the whole populations of these parts to drive the unfortunate leper from their midst. The genius of Christianity, fortunately, was true to itself, and tempered this act by providing "lazar-houses" for the reception of the unfortunate outcasts. The leper everywhere was met with the cry of "unclean"; and to touch him was considered an act only supernatural faith could inspire. This was followed by another circumstance of enormous importance to us in the present day, who have to deal with countries in which leprosy is now as great a scourge as it was in Europe at that time. With extraordinary rapidity, considering the nature of the infirmity, it began to disappear simultaneously with the adoption of the strict measures that were put in force, the disappearance being as rapid and complete as the onset of the disease amongst the populations had been swift and intense."

Present Distribution.—*Sandwich Islands.*—It is during the invasion of new countries and nations by obscure diseases, that some of the laws governing the spread of these diseases may be best studied, because a starting-point with regard to time and place, at least approximately, may be fixed, from which the further growth and spread of the disease can be traced. These conditions given, the laws by which the dissemination of the disease takes place become marked. It is on this account, I think, the following communication received by me from a German physician, Dr. Hillebrand, formerly of Honolulu, is a document worthy of our best consideration. Dr. Hillebrand came to India in 1865 to study the character of leprosy; I then made his acquaintance, and on his return to Honolulu he sent me the following account of the introduction and spread of the disease in that island. Dr. Hillebrand states that—

In the Sandwich Islands, where I have been living ever since 1851, practising the profession of medicine, and to a great extent among the natives of the country, leprosy was unknown before 1859, and after close scrutiny cannot be traced further back than the year 1852, or at the most 1848. A recent census, taken by the Government, established the number of lepers to be about 230, out of a population of 67,000 natives, or nearly $3\frac{1}{3}$ in 1000. As I have good reason, however, to believe that only cases with marked tubercular development have been reported, the simply anæsthetic form not being generally recognised as being of leprous character, this estimate falls rather short of, than exceeds, the reality, which may safely be estimated at 4 in every 1000. The character of the disease was first recognised in August 1859, shortly after the establishment of the Queen's Hospital and Dispensary. It then occurred to me that I had met

with similar cases occasionally, but rarely before, the first of which I could recollect as far back as 1853. Further inquiry among the natives at large brought to light that a few had been observed in 1852 and 1851; and an old chief, well versed in the history of his country and in everything pertaining to his countrymen, referred the first case known to him to the year 1848. In 1859, when I first brought the existence of lepra amongst our people to the notice of Government and the public, only a few cases became known, but with every subsequent year the leprous patients presenting themselves at the public dispensary increased in number, until during 1864 and 1865 it was considered of quite ordinary occurrence that lepers should apply for relief. It is worthy of notice that, soon after the character of the disease became known, the natives began to call it "mai pake," the Chinese disease. Whether this name, derived from a belief that the disease had been imported through Chinamen, of whom there have been a considerable number settled at the island for years, or if it simply owed its origin to the circumstance that they learned from the Chinamen that the disease was common in China, I have not been able to ascertain.

Here, then, we have the important fact of the leprous disease introducing itself amongst a clean nation, spreading slowly at first, so as not to attract attention for many years, but multiplying faster as years roll on, until, after the lapse of at most seventeen years, it has invaded almost every district of our island group, alarms the people, and seriously occupies the attention of the Government and Legislature, who, during the Session of 1865, voted the comparatively large sum of 30,000 dollars for the establishment of a secluded hospital and a leper colony in an isolated locality on one of the smaller islands; in fact, it is regarded as a national calamity. And mark well, in all this, hereditary taint, from the nature of the case, has no share, or, if any, only a most subordinate one. I can only remember a single child under the age of six years, among the great number of cases which have come under my observation. Only one instance, where father and child were affected, can I recall to memory, and in that case the child was born clean, before the disease had broken out in the father.

The question next arises—Have changes taken place in the habits or ways of living of the people for the worse? Do they live on poorer and less wholesome food now than formerly? Are they clad more scantily? Do they live in worse constructed houses?—in a word, are they exposed to the inclemencies of the weather? Are they borne down by oppressive taxation, by forced labour, or anything tending to lower their vital forces, and thereby to prepare a soil well adapted for the spontaneous generation of such a disease? Quite the reverse; on all these points they are better off now than at any time before. Their food is the same which it used to be—viz. a paste formed of the tuber of the *Colocasia esculenta*, a tuber richer in gluten than any other. The country is well stocked with cattle, sheep, pigs, fowl, fish, etc., and animal food is within the reach of every one; for labour is in great demand, and highly paid. While, in former times, a girdle round the loins constituted their whole wearing apparel, now they are decently dressed like Europeans; their former dark and damp straw-huts are rapidly making room for pretty wooden structures, raised from the ground, and well aired. The climate is perhaps the finest in the world, the thermometer ranging between a minimum of 60° and a maximum of 88° F., the trade winds blowing uninterruptedly during summer; malaria is all but unknown. They live under a free constitutional government, and taxation is light. It is true syphilis has, as in most Polynesian tribes, sapped the

life of the nation, and is the main cause of the lamentable decrease of the population; but syphilis and the decrease of population were going on long before the appearance of leprosy, and are making less progress now than before. And, moreover, although lepra invading a body tainted with constitutional syphilis, or having syphilis implanted upon it, assumes a more virulent character, it has been found impossible to make out a specific affinity between the two dyscrasias.

It is also a notable circumstance, that a considerable number of those affected, and some even of the worst cases, belong to the better class of natives, who are well off in every respect.

As to the mode of diffusion over the group, I have been able to gather a few important facts. The first leper seen by me in 1853 lived then in a thinly populated district of the island of Oahu, about twenty miles from Honolulu, in a small village near the sea. When, in 1861, I made inquiries about this man, I learnt from the most trustworthy source that he was now in a far advanced state of the disease; and that in his immediate neighbourhood six other persons had been taken with it. The same thing was observed in the district of Northkona Hawaii, where, towards the end of 1864, about seven cases became known, six of which were reported to have contracted the disease in the village of Kaslua, the tax-collector of which place had, for several years, been the only leper in the district. It must be observed here, that the natives are of very social disposition, much given to visiting each other, and that hospitality is considered as a sacred duty by them. Honolulu, the principal seaport and the capital of the kingdom, of course contributes the largest number to the official lists, while one or two of the remotest districts of Hawaii, which have but little intercourse with the rest of the group, were at the time that the census was taken, yet exempt from the disease. With the patients presenting themselves at the dispensary of the Queen's Hospital, I have made it a rule to ask to what cause they severally attributed the origin of their disease. About one-fourth avow contact with other lepers as the cause, a proportion which may be considered high, considering the shortness of time that the disease has been known, and the long term of incubation, during which the poison must lie dormant in the body, before it manifests itself.

In one family I heard of, a brother, a sister, and all individuals between 14 and 35 years suffered from an hereditary taint. It is well to remark that all these observations refer to tubercular leprosy, which, in an overwhelming majority of cases, has been found combined with anæsthesia, either in the extremities, or in the affected parts themselves, and generally associated with squamous eruptions of the skin—psoriasis. The tubercular affection does not confine itself to the cutis, but can be followed up the nares, producing ozæna, and to the palate and epiglottis, causing sometimes death by laryngeal phthisis. It appears on these mucous membranes under the form of small lenticular or pisiform knobs, which undergo a gradual ulcerative absorption, but never form large or deep corroding ulcers, as does syphilis, from which also the cicatrices are entirely distinct. Simple anæsthesia of particular nervous provinces in the forearm, particularly the ulnar, with contraction of one or more fingers, but without any ulceration of the affected skin, I have occasionally observed also, but their leprous character was not fully acknowledged. Since I visited China and India, however, all doubts on that point have disappeared from my mind.

Without indulging in loose speculations about the nature of the con-

tagion, supposing such to exist, I believe myself borne out by facts when I attribute to it the following characters:—

1. It must be of a fixed nature, either solid or liquid, not diffusible through the atmosphere.
2. It has an unusually long period of incubation.
3. It cannot take root in every constitution; or in other words, some men possess immunity from its attacks.

The very extensive prevalence of leprosy in the Hawaiian Islands can no longer be denied, and it constitutes a very serious problem for the Government of that kingdom. The mere expenditure in money annually reaches a very considerable sum, amounting probably to not much less than 5 per cent. of the total revenue. The evil has attained such large proportions that only by the most rigid enforcement of the law compelling the segregation of lepers can it be combated; this appears to be now fully recognised by the Board of Health, but it was not always so, and it is impossible to avoid the conclusion that the laxness at one time permitted has worked an amount of evil irreparable in this generation. In 1868 official returns gave the number of lepers as 274, and subsequent experience renders it almost certain that this enumeration was rather over than under the mark. This statement is grounded upon the fact that of 368 persons recently sent to the Medical Board of Examination as probably lepers, only 304 were declared to be undoubtedly leprous—that is to say, only 82 per cent. of the supposed lepers were without doubt suffering from the disease. Of the remainder, 22 were certainly not lepers, while as to 42 there was some doubt. At the present time, there are 749 lepers at Molokai, and over 600 still at large in the other islands, so that the Hawaiian kingdom cannot contain far short of 1400. Until quite recently the number at large was very much greater, for between July 1, 1887 and March 31, 1888, no less than 326 were, after careful examination by the Board above-mentioned, which consists of three physicians selected on account of their special experience, consigned to Molokai. The cases are not uniformly distributed, and in some localities the proportion is very large; thus in one valley of the island of Kauai over one-eighth of the population were lepers.

British India.—According to the Census of 1881, out of a population of 216,679,329 people under our rule, and that of feudatories, there were 128,089 persons affected with leprosy. These figures, however, so far as leprosy is concerned, are probably rather less reliable than those would be, if we employed our police constables in this country, on a certain day of the year, to ascertain how many people in England were suffering from eczema. The Indian police have no more definite idea of what leprosy is than our constables have of eczema, and have infinitely less intelligence and common sense. We may safely assert, however, that leprosy is common among the inhabitants of all parts of Hindostan; in some districts it is more prevalent than in others, but all are more or less infected. There are no legal restrictions in India against lepers associating with healthy people, and one sees all over the country, especially in the larger towns, lepers moving about among the people, or sitting by the roadside begging; some of those miserable creatures have suffered

from terrible mutilations of the face and other parts of the body, the result of this disease. The native customs were stricter in this respect before we obtained possession of India, and altered the laws and many of the customs of the country. How far these changes have tended to cause the extension of the disease in India we cannot now determine; but I concur in the opinion of many medical officers conversant with the subject, that leprosy has spread among the inhabitants of India slowly, but surely, of late years.

China.—Leprosy exists throughout the whole of the empire of China; the disease is considered to be contagious, but lepers are often found living with their families during its early stages.

In Havana a lazaret-house was founded in 1861, and at the present time the average number of patients is about 90. During the last twelve years 216 lepers have been admitted into the hospital. The proportion of lepers to the population of the island is 3·75 per 10,000, excluding the Chinese; among this class of the population it is said that 94·34 per 10,000 are lepers; the proportion of men to women affected is as 5 to 1. Leprosy was diminishing in Cuba till the Chinese immigration began into that place.

In Russia, especially about Riga, leprosy has increased within the past few years; in 1887 Dr. Bergmann discovered 37 lepers in the town, and 21 in the neighbourhood. There are now over 100 lepers in this locality. In and around Dorpat there has been a marked increase of the disease within the past few years. Professor Münch collected the history of 800 lepers in Russia (European), and expressed the opinion that, by means of isolation, in thirty or forty years the country might be completely freed from the disease. In the Caucasus, up to 1841, there was a marked increase of the disease; but from that time, segregation of lepers having been enforced, the disease has much diminished.

Leprosy is met with on the west coast of Norway and in Iceland; in certain provinces of Spain and Portugal, and in the Riviera and Sicily. It exists along the Caspian and Black Seas, in the delta of the Volga, and also in the islands of the Levant. It is common in Egypt and the North African States; in East, West, and Central Africa, Madagascar, Mauritius, Réunion, St. Helena, Madeira, Canaries, and Azores. It prevails also in Japan, Borneo, and Siam, and in Brazil, Central America, the West Indies, South America, Mexico, and a few cases are met with in New Brunswick. It has been observed among Chinese immigrants in the United States as far east as Chicago, and in Queensland.

Leprosy hospitals exist in several of the West Indian colonies, as

well as in various parts of Hindostan, in Mauritius, Singapore, Colombo, the Cape and Honolulu, in Canton, Java, and in various localities in Asia Minor.

Cape of Good Hope.—Leprosy has been on the increase for some years past among the inhabitants of South Africa; and also in New South Wales; and both these colonies have lately passed Acts for the isolation of lepers. The enforcement of legal enactments against lepers is of the greatest importance at the present time, not only from an historical, but also from a practical point of view. In the *British Medical Journal* for 25th June 1892, a copy of a *Gazette Extraordinary*, dated 18th May 1892, issued by the Government of the Cape, may be found. The editor of the journal remarks (p. 1427) that this *Gazette* contains the official promulgation of—

“The Leprosy Repression Act, 1884,” and a statement of regulations made under the Act. The object of the Act is thus stated: “To check the spread of the disease known as leprosy.” In the first paragraph of the Act there is a very important statement; and its importance is not lessened, but is rather increased, by the fact that it has recently been asserted that leprosy tends to diminish with the spread of civilisation, and, consequently, of sanitation, in countries prone to this disease. This is the statement: “Whereas the disease of leprosy is prevalent in this colony, and has lately been spreading, and continues to spread . . .” Here, then, is an official announcement of the fact that leprosy “continues to spread” at the Cape of Good Hope. The Act provides that when it is certified by any “duly qualified medical practitioner,” and by a “field cornet,” or justice of the peace, that any person is a leper, “and that the fact of such person being at large is likely to spread such disease, the Governor (of the colony) may, by warrant under the hand of the Colonial Secretary or Under Colonial Secretary, order that such person shall be removed to such asylum or hospital as he shall appoint, to be there detained during the Governor’s pleasure, and kept apart from contact with all other inmates of such asylum or hospital who are not afflicted with the same disease. Provided always that every such person, while so detained, shall have the liberty and privilege of seeing his friends and legal advisers at all reasonable times under such regulations in force for the time being as the Governor may approve in that behalf.” The Act also gives power to compel the keeping of male and female lepers in separate asylums; provides for the maintenance out of the colonial revenues of all pauper lepers, and the making by the “superintendent or keeper” of the hospital or asylum of a special agreement with any well-to-do leper which would require such a leper to pay his own expenses while he is detained in the asylum; prescribes the payment of fees to medical men employed by the proper authorities under this Act; and the giving to the local authority, or to any resident magistrate, by all district surgeons and medical officers, when they are requested so to do, of “any information which may be required in regard to the disease referred to in this Act. . . . Power is given to the Governor to at any time make, alter, and amend such regulations as he may deem to be advisable for the better and more effectually carrying out the provisions of this Act.”

The Governor, with the advice of the Executive Council, has made,

within the last five weeks or so, some important "General Regulations" under the provisions of the "Leprosy Repression Act." It now is the duty of "every field cornet and police constable forthwith to report to the resident magistrate of the district the existence of any case of leprosy which may come to his knowledge." Europeans who are lepers are to be kept in wards into which "native or coloured" lepers are not allowed to go; the sufferers are to be classified "as far as possible" according to their condition of disease; notice of the serious illness or death of a leper is to be at once sent to his nearest relative by the medical officer in charge of the case. Visitors are not to be allowed "to enter any ward set apart for lepers or to visit a leper" without a permit from the medical officer in charge. The only person who has right of private access to a leper is his legal adviser.

To the very stringent legislation here set forth the leper in the colony of the Cape of Good Hope must now submit. As we read the Act, it is still legal in the Cape Colony for a leper to remain in his own home, provided the local authorities do not take action in his case and remove him to an asylum or to a hospital. It seems, however, very unlikely, judging from the tone of the Act, that the local authorities will allow lepers to remain in their own homes unless the authorities are convinced that while in his own home the leper will be carefully isolated and properly attended to in everything necessary to his own wellbeing and to the protection of his neighbours against the infection of leprosy. Here, we suspect, the authorities at the Cape will find some difficulty in carrying out the Act, both as to its letter and its spirit. But we must not forget that the colony is a community strong in the belief that leprosy, whether aided by insanitary surroundings or not, can only make new victims by virtue of the fact of its own infectiveness. Granted that the people have clearly apprehended the meaning of the inevitable consequences of such a belief as this, and have determined to carry their belief into action, then, in this event, it would be indeed venturesome to attempt to measure the amount of success which may crown their efforts. Much—practically everything—will depend upon how this Act is enforced at the Cape. In the interests of the healthy community, and of the lepers themselves, we hope the Act will be strictly carried out now that the people of the colony have decided to try the effect of compulsory segregation in their heretofore unsuccessful attempt to check the spread of leprosy among themselves.

We do not gather from the wording of the Act that the authorities at the Cape have reserved to themselves under it any power of inflicting definite penalties in the case of persons who break the law which it enacts, or even when its provisions are openly set at defiance. Perhaps the authorities have at command some means, which, however, do not seem to be mentioned in the Act itself, wherewith to enforce obedience to its requirements. Should this prove to be a weak point in the working of the Act, we should recommend the authorities at Cape Town to peruse the Act touching the question of the prevention of leprosy which is now in force in the colony of New South Wales. This Act is given in full in Dr. Thin's excellent work on "Leprosy." The New South Wales Act seems admirably suited to the purpose which its authors had in view,—namely, to enforce in the most thorough way the segregation of lepers, and to punish promptly all persons attempting to evade or to thwart the working of the Act.

In the Cape of Good Hope and in New South Wales we see the principle of the segregation of lepers being rigidly enforced. Among our fellow-subjects who follow this line of treatment in dealing with leprosy there is

no evidence of any tendency on their part to lose faith in what they are doing in that direction. They believe that leprosy spreads among healthy people because it is an infective disease, and they decline to postpone to an indefinite future the possible eradication of the disease by trusting to obtain this end by gradually improving their personal hygienic surroundings. The inhabitants of the Cape Colony have leprosy at their doors. We are told there are not wanting there certain sad examples of the truth that no person, in any grade of society, in a country where lepers are free to go about as they please, is safe from attack by this most horrible disease. It is not for us in England to judge harshly of people circumstanced as are the Cape colonists with regard to leprosy, or lightly to blame them for enacting severe laws against the leper. Many people are always eager to show with what calm, philosophical resignation they can regard the dangers and sorrows which, leaving them untouched, fall heavily upon their neighbours. Shall we be reproached for such an expression of opinion as this when to-day in British India lepers are allowed to act as salesmen in the bazaars, and to move about just as they please in the crowded thoroughfares of Indian cities?

Bacteriology.—As in Asiatic cholera, so also in leprosy, the question arises as to whether a specific micro-organism can be demonstrated in the affected tissues; and if so, does its presence there account for the characteristic symptoms of the disease. Professor Virchow, and Dr. Vandyke Carter, of the Indian Medical Service, though working independently, came to the conclusion in the year 1859, that in the enlarged nerves of persons suffering from leprosy, peculiar nucleated and granulated lepra-cells were always to be found. Professor Klebs determined, in 1873, that the tubercles of leprosy contained groups of specific bacteria. A few years later, Armaner demonstrated the fact that the granular lepra-cells of V. Carter enclosed heaps of bacilli. De Bary states that this bacillus possesses protoplasmic contents surrounded by a membrane, outside which is a material which swells up and assumes a gelatinous character so as to envelop the bacillus. It seems possible that it is by means of this gelatinous material that leper bacilli adhere to one another, and form the characteristic clumps so constantly found in the cells of tissues affected with leprosy.

The lepra bacillus resembles that of tubercle; in length it is about half to three-quarters the diameter of a human blood corpuscle. It is straight, but is sometimes slightly curved with rather rounded extremities. The protoplasmic interior of the bacillus may be demonstrated by means of certain reagents, such as iodine, or by staining agents, as hæmatoxylin; the protoplasm appears to break up into rows, with minute spaces intervening. The lepra bacillus multiplies by fission.

The micro-organism of leprosy may be stained by treating sections of affected tissues on a cover glass with a solution composed of the

following ingredients:—100 grammes of water, 5 grammes of carbolic acid, 10 of alcohol, and 1 of fuchsin (Ziehl's solution). The section is to be immersed in this solution for ten minutes, and then decoloured in a 25 per cent. solution of nitric acid; lastly, it must be washed in 60 per cent. of alcohol, and subsequently in distilled water, and mounted in a saturated solution of acetate of potash. Treated in this way the bacillus of leprosy, under the microscope, appears as a bright red rod. Gram's method stains the bacilli well, and demonstrates the divisions in its protoplasm. Fuchsin, gentian, methyl-violet, dahlia, in weak acid solutions stain the bacillus. An eosin-alum-hæmatoxylin solution (Ehrlich) stains the nuclei of the tissues blue, the cell protoplasm of a rose colour, and the bacilli orange.

With reference to the cultivation of the leprosy bacillus, the difficulty in demonstrating its specific character arises from the fact that, so far as we know, none of the lower animals are subject to leprosy, the bacillus having no pathogenic action on them.

In the Report of the Leprosy Commission in India (1890-91, p. 425), various cultivation experiments are described. Fresh "leper juice," that is, fluid drawn from living leprous tissue, was placed in glycerine-bouillon. In a mixture of this kind free leprosy bacilli were found about the tenth day. With fluid taken from a blister formed over a lepra tubercle, at the end of a month pure cultures of the bacillus were found. The Commissioners report that a tube containing such a culture transferred into glycerine-bouillon, at the end of three days the mixture had become slightly turbid; subsequently a pellicle or scum formed on the surface of the mixture; this was well developed about the twelfth day. As this scum was forming, minute greyish particles appeared on the surface of the liquid; these daily increased in number, joined together, so that the whole growth could be seen steadily advancing from the centre to the periphery. In some cases the scum sank to the bottom of the tube in a fortnight. The growth liquefied the gelatine, and it grew well on agar. The scum was found on microscopic examination to consist of a pure culture of leprosy bacilli. Sections made through fresh lepra tubercles, and treated as above, also produced pure cultures of bacilli.

No definite results have as yet been obtained by the inoculation of cultures of lepra bacilli into the lower animals. In man the disease has been communicated in this manner. Keanu, a Hawaiian criminal condemned to death, preferred to have a portion of a fresh leprous tubercle grafted beneath the skin of his left arm, rather than suffer death by hanging. Members of Keanu's family were leprous, but the man himself was free from any

symptoms of the disease, when a portion of fresh leprous tissue was inserted beneath the skin of his left arm. This was done on the 5th of November 1885. Within a month's time of this proceeding, Keanu complained of painful swellings along the course of the median and ulnar nerves of the arm into which the leprous tissue had been grafted; within six months these painful lumps had developed into unmistakable leprous tubercles. In September 1887 the following official statement was published regarding the condition of this man:—

OFFICE OF THE BOARD OF HEALTH, HONOLULU,
September 25, 1887.

This is to certify that we, the undersigned, have this day carefully examined one Keanu, a Hawaiian man, in confinement at the Oahu Gaol, who was inoculated with leprosy by Dr. Arning on November 5, 1885, and we find his condition to be as follows: Ears tubercular and considerably hypertrophied; forehead the same; face, nose, and chin show flattened tubercular infiltration; mouth clean, no tubercles; face generally presents a leonine aspect. Hands puffed, fingers swollen at proximal phalanges, tapering to distal phalanges; tips of forefinger and thumb of left hand are ulcerated from handling hot tin cups of tea or coffee, indicating anæsthesia. Body: black, thickly mottled with flattened tubercles, and the surface uneven to feel, colour of the same a yellowish-brown; front of the body, chest, and abdomen presents plaques of tubercular infiltration of larger size than back, separated from each other by wider intervals, and of a brighter colour, in some cases a ruddy pink, especially over upper part of sternum. Legs: the infiltration thins out as far down as the knees, there being one large bright patch on the inside of the left thigh; legs below knees quite clean, and skin smooth and even to touch. Feet, œdematous, have poor circulation; bluish colour; soles of feet clean. Seat of inoculation, outer aspect of left forearm, upper third, shows a dark purplish scar about $1\frac{1}{2}$ inches long by $1\frac{1}{2}$ inches wide, irregular in shape, keloid in aspect, dense, and inelastic. The tests for anæsthesia were not made. Eyes with scleritis, muddy, and injected. No signs of palsy about muscles of face, orbiculares palpebrarum, hands or forearms. It is our decided opinion that this man is a tubercular leper.

N. B. EMERSON, M.D.
J. H. KIMBALL,
Government Physician,
Honolulu.

Keanu died of leprosy within six years after the date of being inoculated with leprous tissue.

The Indian Leprosy Commission state that "sufficient time has now passed for it to be possible confidently to affirm that the presence of the bacillus lepræ in the new growths of leprosy is absolutely characteristic of the disease. Indeed, this bacillus has a specific relationship in the causation of leprosy. No leper is free from this organism, and in the bodies of those suffering from other diseases it never occurs."

Careful observations have been made with reference to the distribution of leprosy bacilli outside the body. But the evidence is entirely negative; neither in the earth constituting the floor of houses inhabited by lepers, nor in the tank water in which they bathe, could any lepræ bacilli be discovered. The same may be said of fish and of flies; there is no evidence showing that the leprosy bacillus exists in the bodies of the various species of these creatures which have been examined, either in India, or in other parts of the world.

Pathology.—Leprosy bacilli have been found within the cells of almost all the tissues of the body, in persons affected by leprosy; but it is in the cells of the diseased nerves and skin, that the bacillus will be discovered in the greatest abundance; in fact, the cells of such tissues are often crowded with these micro-organisms. It appears to be doubtful if the leprosy bacillus can live for any length of time outside the cell wall; at any rate it has not been found free, either in the blood or in any part of the human body.

Cells occupied by the leprosy bacillus vary much in size, some of them not being larger than white blood corpuscles, most of them are much larger, and the bacillus is not unfrequently found within compound cells. In the early states of its existence the bacillus does not interfere with the life of the nucleus of the cell which it invades; for the nucleus may frequently be seen of its normal size in cells crowded with bacilli. Subsequently, as the cell enlarges, its nucleus degenerates and ultimately disappears. As this disintegration of the living organic matter in the cell progresses, the formed material around it breaks down, and an ulcer in the part is the result of a process of this kind.

Nerve Leprosy.—In the early stages of this form of disease the bacilli first grow within the cells forming the sheath of one or more nerves, most frequently of the ulnar nerve. We find in this stage of the disease that an enlargement of the affected part of the nerve takes place, the swelling being due to an over-growth of its fibrous elements; among these fibres numerous cells may be found full of the leprosy bacilli. The secondary as well as the primary sheath of the nerve is affected in this way, and as the abnormal growth of the fibrous tissue increases, it presses upon the central axis of those nerve fibres which pass through it, and in consequence the functions of these fibres become impaired beyond the seat of the disease. Above the site of this over-growth of fibrous tissue the nerve may be perfectly healthy, and in passing through the diseased area a number of the nerve fibrillæ may escape destructive changes, and consequently perform their functions more or less perfectly.

Anæsthesia of patches of skin supplied by nerves which have been invaded by the leprosy bacillus is common, and is one of the most prominent features of this form of disease. Beyond atrophy of the subcutaneous fat and muscle fibres, no definite changes are observed in the tissues of anæsthetic portions of skin. But at a later stage of the disease, in consequence of the malnutrition following changes in the nerves, such as those I have referred to, ulceration of the skin occurs, and ultimately necrosis of the fingers, toes, and other parts of the body may follow. The loss of pigment in the skin, so constantly seen in well developed cases of leprosy, is attributable, like the anæsthesia, to defective innervation of the part.

Tubercular Leprosy, from a pathological point of view, differs in no way from nerve leprosy; in the one case the cells entering into the formation of the skin being invaded by the leprosy bacillus, and in the other the connective tissue cells of the nerves are similarly affected. If an incision is made through a leprosy swelling of the skin, or a tubercle as it is commonly called, a viscid fluid may be squeezed from the surface of the incision; and this tenacious matter under the microscope is found to contain a vast number of cells, more or less crowded with leprosy bacilli. If the tubercle has existed for a considerable time, its cut surface presents a yellowish-white appearance, and a number of small spaces may be seen filled with the gelatinous substance above referred to. The abnormal growth is almost confined to the corium, the cutaneous structures in the first place becoming sclerosed; the sheaths of veins and vessels passing through this diseased area of skin also become thickened, and the circulation and innervation of the part is consequently impaired, so that degenerative changes occur, and extensive and deep ulcers form over the surface of the body. The skin of the face and ears, as well as of the hands and feet, in fact of the whole body, is thus often extensively diseased; cartilage and mucous membranes, especially of the larynx and epiglottis are frequently involved, as well as the lungs and other parts of the body.

Sections made through portions of skin affected with leprosy, and examined under the microscope, show a vast number of cells containing bacilli in the connective tissue. These cells are of all shapes and sizes, and unless in the advanced stage of the disease have well marked nuclei. The bacilli are often seen in sections made through the skin and hair follicles; their presence in the epidermis affords a means by which they may leave the body although the skin has not ulcerated. When ulcers have formed, a vast number of bacilli contained in cells must be thrown off the body, for the surface of

these ulcers is constituted of layers of cells, in almost every one of which colonies of the leprosy bacillus may be found. But the older colonies are dead, for in by far the majority of these cells the nucleus has disappeared; and without the nourishment which the connective tissue nucleus secretes, the leprosy bacillus cannot live; this secretion appears to be the appropriate food of this micro-organism. The connective tissue cells of the iris, cornea, and conjunctivæ are not unfrequently in leprosy patients invaded by the bacillus, which leads to sclerosis and chronic destruction of these tissues.

Etiology of Leprosy.—In the *Dublin Journal of Medical Science* for June 1877, Dr. Hawtrey Benson published the following case: "In 1872 Dr. Benson brought a man to a meeting of the Medical Society affected with tubercular leprosy, which commenced whilst the patient was in the West Indies, where he had resided for twenty-two years. After this individual had been under treatment in hospital for some weeks he was allowed to return to his home; he died there about eighteen months afterwards. After leaving the hospital, until shortly before his death, this leper's brother slept in the same bed with him, and wore the same clothes. This brother had never been out of Ireland, except on one occasion to England; there was no other case of leprosy in the family, but this man contracted the disease, and was shown to the members of the Dublin Medical Society on the 2nd of May 1877, suffering from tubercular leprosy."

Father Damien de Venster was born in Belgium with no trace of leprosy in his family; he left Europe in 1873 in order to devote himself to the relief of the lepers in the Hawaiian Islands. During the time he lived in the leper settlement of Molokai he ministered to the religious and material wants of the lepers; so far as he was concerned he treated them as he would have done any of his other fellow creatures.

In 1882 Father Damien first showed symptoms of leprosy; it commenced in his left foot, and in July 1889 he died of leprosy.

I have already referred to the case of the convict Keanu (p. 437), who developed fatal leprosy after having had a piece of fresh leprosy tissue grafted into the skin of his arm.

I may here mention two cases of leprosy which have been under my care in London within the past few years; both patients were Englishmen, born and reared in this country, with no suspicion of leprosy in their families.

"A. after serving in India for some years was sent to Burma; he married a native woman, and in due time a son was born. The

child when 6 years of age was sent to England; when 11 years old, being still in this country, he developed tubercular leprosy, from which he died. His father in the meantime showed symptoms of leprosy. He left India and returned to England; the disease ran a slow course, and he died fifteen years after he became a leper. Before his death this patient's sight had been destroyed; his whole body and face was covered with leprosy ulcers."

"B., a remarkably powerful man, served in the North-Western Provinces during the greater part of the time he was in India. He lived with a native woman for two years; some three years after this he became affected with tubercular leprosy. This man returned to England, and the change of climate appears to have arrested the progress of the disease. But the disease had destroyed his sight, and he presents marked tuberculous nodules over various parts of the body." These cases are known to other members of the profession in London, and there can be no question as to the nature of the disease or the circumstances of the patients as above given.

The three members of the Commission sent out from England in 1890 to inquire into the circumstances of leprosy in India, arrived at the conclusion that the disease "in the great majority of cases originated *de novo*," and that the extent to which leprosy is propagated by contagion "is exceedingly small." These Commissioners, before leaving England, were unacquainted with the language, habits, or prejudices of the natives of India, nevertheless it was from the evidence they collected from natives that the above opinion was formed; the Commissioners preferred their own judgment as to the matter at issue, rather than depend upon those who had resided among, and treated the diseases of the natives for many years. The Commissioners remark, at p. 259 of their Report, that, as a rule, our Indian civil surgeons believe that leprosy is a communicable disease, and that it spreads from diseased to healthy people in this way. But the Commissioners add that it is not "permissible to be too much guided by the opinion of medical observers in India—because most civil surgeons have not much opportunity of studying the etiology of this disease." Having been an Indian civil surgeon for some years, I beg to differ from the Commissioners in this opinion. I had frequent opportunities of watching cases of leprosy, often for several consecutive years, among the natives of India, and so of studying it in its various forms, and learning the family history of many such patients. The opportunities I enjoyed were not singular, and are within the province of most civil surgeons in India, for the disease is disseminated throughout the length and breadth of that vast and thickly populated

country. It seems to me that the opinion of our medical officers in India on this subject is deserving of every respect; and that as by far the majority of them believe from their own experience that the disease is communicable, their opinion is of great weight in a question of this kind.

The Rev. H. P. Wright, in his work on *Leprosy an Imperial Danger*, gives the following particulars of cases of leprosy (p. 33):—

(1) Betty MacCarthy, of Prince Edward's Island, native of Lancashire (England), married in 1836. In 1852 she became ill, and died of leprosy. She had five children.

(a) Richard, who died of leprosy, having suffered from the disease for twenty years.

(b) John, who died of leprosy, after suffering for twelve years.

(c) Mike, died of leprosy.

(d) William, died of leprosy. He was washed and buried by Joseph Brown.

(e) May, died of leprosy; she married John Doyle.

(2) John Doyle, died of leprosy.

(3) and (4) Two daughters of John and May Doyle died of leprosy.

(5) Joseph Brown, above referred to, died of leprosy.

(6) James Cameron, of Scotch origin, married, in 1866, Susan MacCarthy, one of the daughters of Betty, and had by the marriage two children, who, and the mother, are in good health. He often slept with Mike MacCarthy, and in 1870 presented undoubted symptoms of leprosy.

Dr. Thin, in his work on leprosy, has given numerous cases in which the communicability of leprosy from a diseased to a healthy person seems to have been established. I may also refer to the evidence afforded by Dr. Emerson, who was appointed by the Government of Honolulu in 1888 to "examine and authoritatively determine" the state of certain attendants on the lepers confined on the island of Molokai. Dr. Emerson reports that—

Of the number examined sixty-six had at their own earnest importunity been granted permission by the Board of Health to enter the Settlement as non-leper *kokuas*, or helpers, to aid in the work of the Settlement, and in the care of their leper relatives and friends. Let me say that the duties of the *kokua* have a wide range, including nursing and care of the sick, fetching wood, water, rations, and other articles, cooking and washing for the disabled ones, and burying the dead. These *kokuas* are, as a rule, married to lepers, live in the same houses with them, and in every way conduct themselves as though they had neither fear nor care for the possibility of contagion. These people had been at the Settlement for periods varying in length from two or three to fifteen years, during which time they had been constantly exposed to the contagious influence of leprosy to such a degree and in such a variety of ways, that, short of actual inoculation, it would seem difficult for human ingenuity to devise conditions and methods more likely theoretically to communicate the disease than those which they had thoughtlessly employed and put into operation in the conduct of their daily life.

As a result of this examination, of the 66 *kokuas* that came before this Commission, 39 were declared to be lepers, 11 *suspects*, and 16 *not lepers*.

The conclusions to be derived from these facts is clear and direct. These people, while presumably not affected with the disease, enter upon such conditions of life as to expose them in as complete a manner as possible to the danger of its reception, with the result that 39 out of 66, or 59 out of 100—taking the latter as the whole number of *kokuas*—were actually infected by it.

There occur to me many other instances of lepers that I could mention by name were it proper so to do, which, after careful consideration, I have been led to regard as undoubted instances of contagion.

The force of the positive evidence in favour of contagion cannot be broken or weakened by the numerous instances of those who have escaped after seeming exposure to the disease.

I have already referred to Dr. Hillebrand's account of the introduction and dissemination of leprosy among the inhabitants of Honolulu (p. 429).

From a study of the history of this disease, its bacteriology and pathology, and from experience among a community where leprosy is frequently met with, I have come to the conclusion that it is caused by the action of a specific micro-organism. In fact, leprosy is a parasitic disease, and cannot therefore arise "*de novo*, or from any concurrent causes"; the only cause of leprosy is the bacillus of leprosy. Doubtless, this micro-organism presents great difficulties when we attempt to study its nature, its method of development, and the conditions of the soil or tissues in which it grows; in truth, these conditions are unknown to us at present; but, because this is the case, we should all the more firmly hold to the fact that the leprosy bacillus is the cause of the disease. If we act on this knowledge, all the rest will follow in the course of time; meanwhile we may do something towards mitigating the terrible evil which this disease inflicts upon a vast number of human beings; it is stated that in India alone there are 106,599 lepers, and this, I imagine, is far below the actual number of persons afflicted with leprosy in Hindostan.

Vaccination in relation to Leprosy.—The following case, given upon the authority of Professor Gairdner, of Glasgow, seems to point to the fact that it is possible the disease may be communicated from a diseased to a healthy person in vaccine lymph. I have taken the following details from Dr. Thin's work on leprosy, p. 193. A medical man residing in one of our colonies vaccinated his son with lymph taken from a child belonging to a family in which leprosy was known to exist. A Scotch ship captain's child was subsequently vaccinated from the child of the medical man above referred to, and Professor Gairdner saw both these children in

Scotland suffering from tubercular leprosy. "The child of the doctor living in a colony where leprosy is not uncommon may have acquired the disease independently of the vaccination. The child of the ship captain, on the other hand, visiting the colony only temporarily, had much less chance of acquiring the disease, and the presumption in favour of the vaccination is very much stronger."

Dr. Thin refers to other cases of a similar kind, which seem to render it probable that leprosy may be conveyed from an affected to a healthy person in vaccine lymph; and in localities where leprosy is endemic, we should be careful as to the source from which vaccine lymph is obtained.

Hereditary Transmission of Leprosy.—It is now held by all the best authorities on leprosy, that the disease is not transmitted through heredity from parent to child.

Symptoms.—In describing the symptoms of leprosy we may divide the cases into two classes, nerve, and tubercular leprosy; but we shall find that not less than 35 per cent. of the patients we meet with suffer from the mixed form of disease both nerves, and cutaneous structures having become affected with the leprosy bacillus.

Nerve Leprosy is more common among the natives of India than the tubercular form of the disease. In the early stages of this affection the patient suffers from feverish attacks, and more or less disturbance of his general health. But the first characteristic symptom which attracts attention is a burning, tingling sensation in patches of skin over various parts of the body, most commonly the back of the hands or forearms. Together with this uncomfortable sensation in the skin, the colour of the integument becomes altered; in some cases it grows darker, in others the skin pigment is diminished, and the part becomes whiter than the surrounding skin. At the same time, it frequently happens that an erythematous eruption appears over the affected patches of integument; this rash consists of pimples varying in size from a lentil, or less, to that of a pea; the spots last for a week or longer, and then disappear. The epidermis has a tendency to disquamate subsequently to the drying up of the eruption; after repeated attacks of this kind the surface of the skin becomes raised and thickened. This condition of things may continue for several years without the disease making any further progress; but in most cases, together with these changes in the skin, if the hand or forearm be affected, the muscles forming the ball of the thumb shrink, and there is a marked alteration in the conformation of the palm of the hand.

This wasting of the muscles also leads to loss of power, so that the patient's grip is weakened, and he has difficulty in writing and performing other delicate movements of his fingers and hands.

As the disease progresses the discoloured spots over the skin assume, from their centre outwards, a pale brown or dirty white colour; and at the same time the part becomes anæsthetic, with, it may be, hyperæsthesia in the surrounding skin. The patches enlarge and run into one another, so that considerable portions of the integument become anæsthetic and lose their natural colour. Over these patches the hairs turn white, and the cutaneous secretion ceases. Patches of this kind are, as a rule, rudely symmetrical, and appear over any, or it may be the greater part of the limbs, trunk, and face, but not over the scalp. These changes may occur without any material derangement in the state of the patient's health; and, as a rule, they progress very gradually for years, at one time with greater rapidity than at others, but always with remarkable slowness in their general advance. In some cases, however, the patient complains of severe neuralgic pains over various parts of his head, face, and limbs; this is particularly the case when the eyes are affected with leprosy. The supraorbital neuralgia is then at times excruciating, and is only to be relieved by the removal of the diseased eyeballs, supposing, of course, the sight has been completely destroyed, as it too often is in cases of leprosy when once the bacillus has become located in the inner structures of the eyeball.

In the more advanced cases of nerve leprosy, the ulnar and other nerves may be felt to be considerably thickened; and sooner or later bullæ form over the anæsthetic patches of skin. These bullæ vary in size from a hazel nut to that of a hen's egg, and contain a viscous yellowish fluid. They burst and leave an encicatrised red patch of skin, which in time is covered with a scab under which inflammation takes place, so that a depressed cicatrice forms over the site of the previously ulcerated surface. Bullæ of this kind seem to occur over anæsthetic portions of skin, in consequence of burns or injuries to the part; but they frequently form independently of any such exciting cause. On the sole of the foot, most commonly over the ball of the great toe, we sometimes meet with what are called perforating ulcers in cases of severe leprosy. These ulcers commence in a bleb over the affected part; but in place of superficial ulceration of the integument following, a circumscribed slough of the thick skin and subcutaneous structures of the sole of the foot occurs; the uncovered tissue in the course of time separates, and a deep painful ulcer remains, which is most difficult to heal.

In fully developed cases of nerve leprosy, necrosis of the fingers, and it may be of the toes and part of the foot, not unfrequently takes place. The part becomes painful and swollen, and the patient suffers from feverish attacks. The swollen skin gives way, and there is a constant flow of pus from the sore. The pain now diminishes, but the affected phalanx mortifies and separates from the living tissues, leaving a healthy granulating surface, which cicatrises in the course of time. One phalanx after another may separate in this way, until the fingers and toes disappear as well as the bones of the metatarsus and tarsus. In fact, the hands and feet of lepers may in the course of years be destroyed in this way.

During the later stages of this form of disease, the patient's health fails, he becomes anæmic, and is liable to visceral complications. Among these complications amyloid degeneration of the kidneys and liver, with chronic diarrhoea, terminate the patient's sufferings, which in many cases extend over a period of fifteen or twenty years.

Tubercular Leprosy commences with febrile symptoms, which in the course of time are followed in many cases by patches of leprous erythema, similar to that described in cases of nerve leprosy. After successive crops of erythema have appeared, or it may be there has only existed a burning, tingling sensation in the part, more or less continuously for months, the patch of skin affected becomes raised and thickened. These indurated patches of integument increase until they assume the form of nodules or tubercles; the hair over their surface disappears, the sebaceous follicles are dilated, and the skin looks smooth, greasy, and shining, a condition not inaptly described as resembling the rind of an orange when it is squeezed between the fingers. The colour of these tubercles varies in different races; in the light skinned they appear of a coppery colour, in darker races of a yellower hue than the surrounding integument. Tubercles most frequently commence over the skin of the forehead, the eyebrows disappear to a great extent; at the same time the lobes of the ears and the cheeks present the peculiar changes in the integument above referred to. It may be, however, that these changes commence in the skin of the arms, back of the hands, or some other part of the body. The mucous membrane of the larynx and mouth is commonly affected, and the patient's voice becomes husky. When fully developed, the skin of a patient's forehead is studded with tubercles, between which are horizontal furrows; his cheeks look greasy and tumid, and are covered with tubercles of various sizes. His lips are thickened and everted; his nose is flattened and widened, and the lobes of the ears are enlarged

and nodular. The conjunctivæ covering the globe of the eyes are yellowish and indurated, especially round the margin of the cornea; at a later stage of the disease the cornea becomes infiltrated, and a dense leucoma supervenes, with corresponding changes in the iris and deeper structures of the eye, leading to loss of sight. The skin over the back of the hands, arms, and, in fact, the whole body, may in the course of time become covered with elevated tubercular nodules, and as these increase in size, ulcers form on their surface; many of these sores last for years, others become covered over by a scab, and separation takes place beneath it, resulting in a depressed cicatrice. In many advanced cases the ulceration extends deeply into the fingers and toes, and these parts, as well as the nose and cheeks, are destroyed, producing the most hideous deformities. The various lymphatic glands of the body become enlarged, and ultimately break down; fistulæ form, the discharge from which, as well as that from the surface of the skin, is most offensive.

After years of suffering the patient's life is at length brought to an end by the extension of the leprosy to the mucous membrane of the larynx, lungs, intestines, and other parts. Lardaceous disease of the spleen, kidneys, and liver are not unfrequent complications of the latter stages of tubercular leprosy.

Treatment of Leprosy.—*Preventive.*—Leprosy being a parasitic and communicable disease, strict isolation of lepers must be the proper and only effective way of stamping it out. But in the present state of society, especially throughout the greater part of Asia, the complete segregation of lepers is impossible. I have already referred (p. 434) to the details of the Leprosy Repression Act of 1884, passed by the Legislative Council of the Cape of Good Hope. The provisions of this Act are excellent, as were the reasons given for its enactment, viz. that the "disease of leprosy is prevalent in the colony, and has lately been spreading, and continues to spread." The Government of the Cape have taken the right means to prevent the extension of the disease among the people committed to their charge, and doubtless under measures of this kind leprosy will in the course of time disappear from the colony. Our fellow countrymen in Australia have adopted precisely similar steps with reference to the treatment of lepers, segregation of the affected from the healthy community being the principle upon which they have founded their legislative enactments. There can be no question, if it were possible to carry out a similar system of isolation in India, leprosy would in the course of years disappear from among the inhabitants of that country; but, as I have said, this is impracticable. The religious feeling, customs, and habits of the

natives, as well as the number of lepers in India, all prevent the Government from attempting to introduce a system of compulsory segregation in that country. What I mean is that, so far as my knowledge goes, however desirable it may be to segregate all the lepers in India, it is impracticable, and consequently the best we can do for our fellow subjects in that country is, to make such provision for, and to draw such restrictions round, lepers as are possible in existing circumstances.

It would seem to be well within the power of the Government of India to enact certain measures for the protection of healthy persons against lepers. These measures may be divided into two classes: A. Permissive; B. Compulsory.

A.—I. For the isolation of lepers restrained in their homes at the express wish of friends; suitable separate lodgment would be necessary in such cases.

II. For founding leper colonies or villages, consisting principally of the affected, who, while allowed a considerable amount of liberty of movement, should be prevented from mingling with the healthy surrounding population.

B.—I. Adequate asylums to be provided for lepers in all the large towns and civil stations of India.

II. Authority to prevent the sale of articles of food and drink by lepers; to prevent such persons from practising prostitution; or from carrying on such occupations as that of barber, washerman or washerwoman; or any occupation which concerns the food, drink, and clothing of the people generally.

III. Authority to take up vagrant lepers; to succour the sorely diseased who may be insufficiently guarded, or cared for, at home; and at times to enforce continued isolation of lepers until medical sanction of liberty is granted to them.

The Government of India, as I am informed, had actually prepared a Bill as far back as 1889, which they were ready to have introduced into the Legislative Council regarding the preventive treatment of lepers. The action of Government was, however, stopped in consequence of the proposed despatch from England of a Commission to examine into the subject of leprosy. The provisions of the measure proposed by the Indian Government were to give power (1) for the expenditure of funds on the appropriation of property to retreats; (2) for the detention of lepers in retreats at their own request; (3) for the detention of lepers otherwise than at

their own request (district magistrates to have power to place suspected persons in retreats); (4) for the discharge of lepers from retreats; (5) for the recovery of lepers escaping from retreats; (6) for the segregation of the sexes; (7) for the protection of the religious belief of the lepers. Local governments would have been allowed to make rules regarding the inspection of retreats, and powers of inspectors, the management of retreats, the conduct of lepers in retreats, the exercise of authority to discharge lepers, the punishment of lepers escaped and brought back, and the carrying out of the Act generally.

Hygienic Treatment.—In cases of leprosy, especially in its early stages, it is advisable, if possible, to remove the patient from the locality in which he has contracted the disease, and to place him in a bracing and healthy district. At the same time every care should be taken that he is surrounded by favourable sanitary conditions, in fact, placed in circumstances conducive to the promotion of good health. In the case of many lepers it is impossible to remove them to a bracing climate; but, by proper restrictions and isolation, most of them might be provided with comparatively healthy homes. The crippled, and often hideously deformed lepers too often seen wandering about the bazaars of our large Indian towns, are not only a disgrace to humanity, but it is hopelessly beyond the power of any one to attempt to relieve them under existing laws.

Medical Treatment.—As regards local applications to the skin, the oil expressed from the choulmoogra nut has been extolled as being almost a curative remedy in cases of leprosy. The oil is to be rubbed into the skin twice a day, for fifteen or twenty minutes at a time. The oil may also be taken internally, in doses of twenty drops two or three times a day. I think there can be no question that patients treated in this way, provided they are also supplied with pure air, water, and wholesome food, do improve; the disease may probably be stayed in its progress by these means, but I question if it can be cured.

Gurgun oil and kowti have also been employed as external applications in cases of leprosy with unquestionable benefit in alleviating the symptoms. But, after long continued use of these drugs by friction over the skin of the affected parts, most practitioners have arrived at the conclusion that they are in no way superior in their action to that of choulmoogra oil.

Arsenic, administered internally for months together, has seemed to me more beneficial in the treatment of leprosy than any other drug. In cases of comparatively recent leprosy, especially when the crops of tubercles appear after feverish attacks, there can be no

doubt that a continued course of arsenic, together with careful hygienic treatment, will arrest, if not cure, the disease. In combination with arsenic taken internally, friction with choulmoogra oil should be used externally.

Ichthyol and salol, in full doses, are highly spoken of by some medical men as having a salutary influence in the treatment of leprosy. But our efforts must be directed to discovering some chemical substance which will kill the leprosy bacillus after it has invaded the cells, entering into the formation of the affected tissues. The difficulty is to find such a compound, which, while destroying the bacillus, will not otherwise harm the patient's general health.

It has been proposed to employ nerve-stretching for the relief of leprosy, and an operation of this kind may be useful in deadening the intolerable neuralgia which some lepers suffer from. With this object in view nerve-stretching may be practised, but beyond relieving pain the operation can do no good in cases of this disease. Excision of cutaneous tubercles has also been recommended, and should cases of tubercular leprosy come under our care in which one or more isolated tubercles exist which can be removed, no harm can result from this practice.

In instances of deep perforating ulcers relief may be given, and healthy action in the ulcer follow the excision of the diseased tissues surrounding the sore, or by their complete removal with a sharp spoon. The cavity left after such an operation, as soon as the bleeding stops, may with advantage be packed with powdered boracic acid.

With reference to the treatment of diseases of the eye, occurring in consequence of the growth of the leprosy bacillus in the part, little can be done. Atropine should be employed to stop, if possible, the formation of adhesions between the iris and lens. In some cases iridectomy is necessary; and, as I have before remarked, if the sight has been destroyed, we may have to remove the globe of the eye to relieve the neuralgia from which such patients sometimes suffer.

